INVENTORY OF WASTE OIL VOLUMES GENERATED IN THE WESTERN NORTHWEST TERRITORIES

JANUARY, 1990

Northwest Territories Renewable Resources
Pollution Control Division

92-01463/

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File No.: 53-053-01-01

Department of Renewable Resources
Government of the Northwest Territories
Yellowknife, N.W.T.
X9A 2L9

Attention: **Mr. Emery Paquin**
Assistant Director

Dear Sir:

Reference: **Waste Oil Inventory**

Enclosed is the final Waste Oil Inventory report, which incorporates your comments and all recent waste oil data received. We trust this document will provide the Department of Renewable Resources with a valuable tool for dealing with waste oil in the Northwest Territories.

It was a pleasure working with you on this interesting assignment and we look forward to continued co-operation in the future.

Sincerely,

Ian B. Macleod, P. Eng.
Manager, Yellowknife Office

Konrad M. Fichtner, Dipl. Ing.
Waste Management Specialist

KMF/jf

Enclosure

Canada Export Award Prix d'excellence à l'exportation canadienne

INVENTORY OF WASTE OIL VOLUMES GENERATED IN THE

WESTERN NORTHWEST TERRITORIES

TABLE OF CONTENTS

1.0 INTRODUCTION AND APPROACH

2.0 DATA PRESENTATION

2.1 GENERAL

2.2 WASTE OIL QUANTITIES BY PRODUCING CATEGORY

2.3 WASTE OIL QUANTITIES BY REGION

2.4 WASTE OIL QUANTITIES BY DISPOSAL METHOD

2.5 COMPARISON OF QUANTITIES WITH 1987 STUDY RESULTS

3.0 SUMMARY AND CONCLUSION

APPENDICES:

A. TELEPHONE QUESTIONNAIRE

B. PERSONAL COMMUNICATIONS

C. BACKGROUND CALCULATIONS

D. COMPUTER SPREADSHEET

INVENTORY OF WASTE OIL VOLUMES GENERATED IN THE

WESTERN NORTHWEST TERRITORIES

LIST OF TABLES

2.2.1	WASTE OIL IN THE NWT BY PRODUCING CATEGORY
2.3.1	WASTE OIL IN THE NWT SUMMARY BY REGION - SOUTHWEST REGION
2.3.2	WASTE OIL IN THE NWT SUMMARY BY REGION - WEST CENTRAL REGION
2.3.3	WASTE OIL IN THE NWT SUMMARY BY REGION - NORTHWEST REGION
2.3.4	WASTE OIL IN THE NWT SUMMARY BY REGION - NORTH CENTRAL REGION
2.4.1	WASTE OIL IN THE NWT SUMMARY BY DISPOSAL METHOD
2.5.1	DEVELOPMENT OF WASTE OIL QUANTITIES BY PRODUCING CATEGORY
2.5.2	DEVELOPMENT OF WASTE OIL QUANTITIES BY REGION
2.5.3	DEVELOPMENT OF CONTAMINATED FUEL QUANTITIES BY PRODUCING CATEGORY
2.5.4	DEVELOPMENT OF CONTAMINATED FUEL QUANTITIES BY REGION

LIST OF FIGURES

		Following Page
2.3.1	STUDY REGIONS	2.4

1.0 INTRODUCTION AND APPROACH

In 1987, Stanley Associates Engineering Ltd. prepared a report for the Government of the Northwest Territories titled: "Inventory of and Recycling Alternatives for Waste Liquid Petroleum in the Northwest Territories". Within the context of that report, a waste oil inventory was compiled to provide a basis for the assessment of alternative strategies.

The purpose of this report is to update the almost three year old inventory, to provide more precise estimates where possible and to include new waste oil generators, if any. Comparison with figures from the 1987 report permits the identification of trends.

Accurate records of waste oils are only kept by large oil companies, mining companies, utilities and larger airlines. Quantities provided by smaller generators must be considered "best estimates". All larger generators were interviewed, and a cross-section of smaller waste oil producers was contacted. Survey results, in conjunction with NWT statistics, allowed the calculation of quantities for all categories and regions.

All data received, estimated and calculated are compiled based on various criteria:

- Major types of oil
- Producing category
- Geographic region
- Disposal method and quantities in storage
- Comparison with 1987 results
- Sensitivity to economic activity

This report concludes with a summary of findings and an assessment of identified trends.

2.0 DATA PRESENTATION

2.1 GENERAL

Data collected are presented in a format similar to that used in the 1987 report to allow comparisons between the two reports. However, certain refinements and improvements are incorporated into this report that reflect the availability of more detailed statistics and information.

In the 1987 report, waste oil generated by vehicles was estimated for regions only; in this report it is presented for each community. Similarly, waste oil quantities generated by smaller aircraft and industrial equipment are estimated by community based on actual numbers of aircraft, contractors, and their location. To cover waste oil generated by unregistered vehicles, boats, private aircraft and other machinery not covered in the survey, an additional waste oil quantity of 1 litre per person per year has been estimated based on conversations with respondents. Detailed waste oil quantity and distribution calculations are included in Appendix C.

2.2 WASTE OIL QUANTITIES BY PRODUCING CATEGORIES

The following major waste oil producing categories have been identified:

A. Marine Transport, comprising the two major barge companies servicing the Western NWT.

B. Air Transport, which includes major airlines that fly out of the NWT, as well as all local airline, charter and rental companies. Privately owned aircraft are included under "unregistered vehicles" since a list of registrations was not obtainable.

C. Industries, comprising mining operations, oil production, and oil and gas exploration. Also included in this category are contaminated fuels from bulk fuel distributors.

D. Public Services, including utilities, territorial and local public works and transportation departments.

E. Vehicles, comprising:

- equipment for construction of buildings, highways, infrastructure projects;
- long distance trucking and bus lines to points outside the NWT;
- personal automobiles, light and medium duty trucks, vans, dumptrucks, motorhomes, buses, taxis, firetrucks, tow trucks, motorcycles, and A.T.V.s.

F. Miscellaneous, such as oil from unregistered vehicles, privately owned aircraft small boats and equipment.

Estimated waste oil and contaminated fuel quantities sorted by producing category are presented in Table 2.2.1.

TABLE 2.2.1

WASTE OIL IN THE NWT

BY PRODUCING CATEGORY

	Category	Lube Oil l/a	Contaminated Fuels l/a	Solvents l/a
A.	Marine Transport	27,300	45,000	0
B.	Air Transport	15,300	0	0
C.	Industries			
	- mines	255,000	0	0
	- oil and gas	408,434	38,900	1,100
D.	Public Services	130,720	0	100
E.	Vehicles			
	- construction	323,700	0	0
	- commercial	196,566	0	500
	- personal/small	257,172	0	0
F.	Miscellaneous (based on 1 litre per person per year)	35,229	0	0
TOTALS		**1,649,421**	**83,900**	**1,700**

The largest generators of waste oil are vehicles. Taken together, construction, commercial and personal/small vehicles generate 47% of the total waste oil. Industries are the second largest contributor of waste oil at about 40%. Public services generate an additional 8% of which 7% is from the utilities sector.

Contaminated fuels play a relatively unimportant part, since contaminated fuel quantities are only about 5% of waste oil quantities.

Compared to waste oil quantities, volume of solvents reported is only about 0.1%.

2.3 WASTE OIL QUANTITIES BY REGION

For the purpose of this study, the western Northwest Territories are divided into four geographical regions, depending on transportation access and routes:

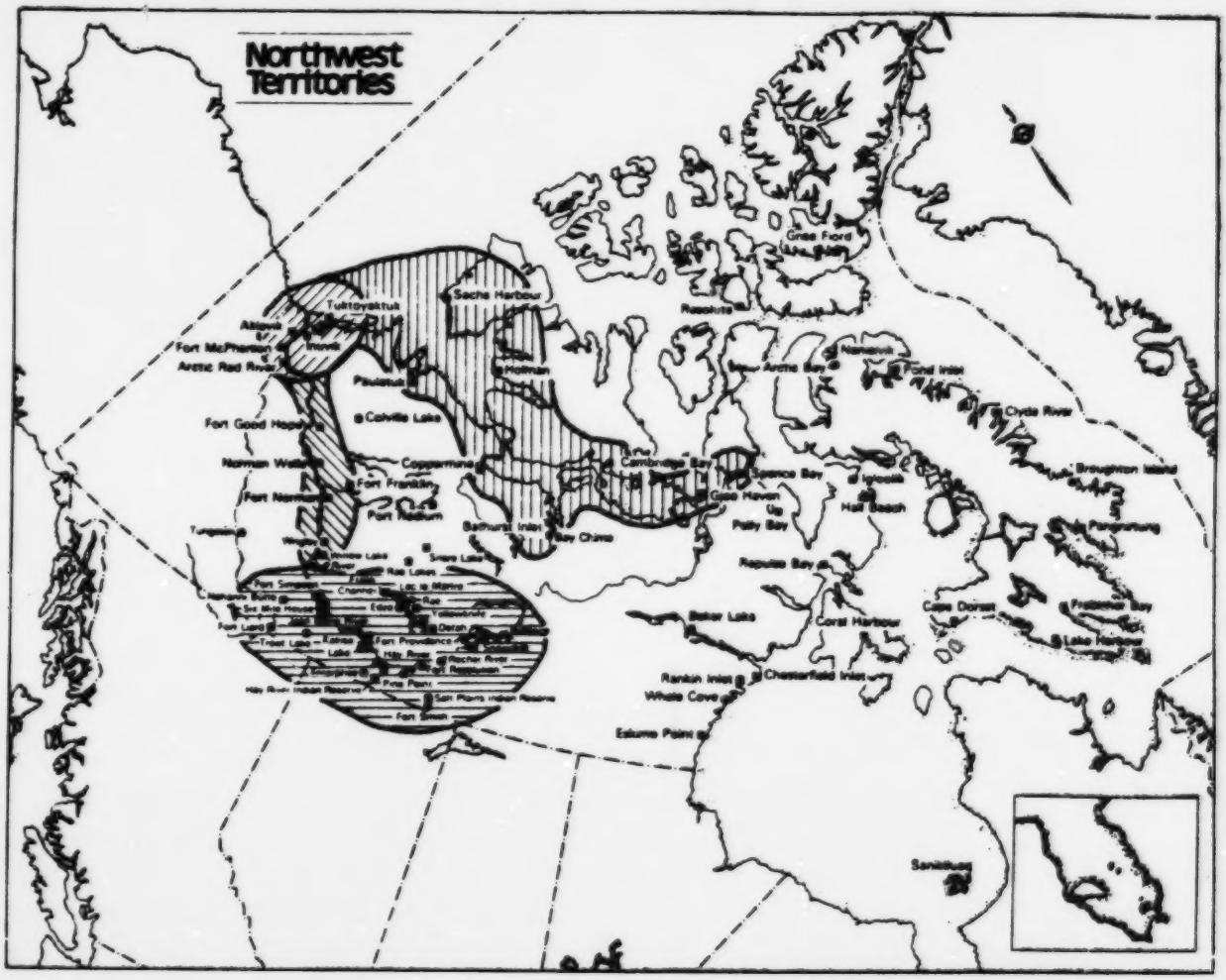
1. **Southwest**: Those communities accessible by road (and winter road) via MacKenzie Highway.

2. **West Central**: Communities along the MacKenzie River accessible by barge or winter road.

3. **Northwest**: Communities accessible by truck via Demster Highway and/or winter road.

4. **North Central**: Those communities north and east of Inuvik only accessible by barge from Hay River.

The geographical regions covered by this report are presented in Figure 2.3.1. Waste oil quantities by region are presented in Tables 2.3.1 to 2.3.4. These tables show waste oil and contaminated fuel quantities for each individual community with a population of over 500. Smaller communities are grouped together. Population figures are from 1988 and were obtained from GNWT Department of Statistics.



SERVICE AREA		POPULATION (1988 est.)	FREIGHT SERVICE BY:
1.	SOUTHWEST	23,506	TRUCK VIA MACKENZIE HIGHWAY CNR TO HAY RIVER
2.	WEST CENTRAL	2,456	BARGE FROM HAY RIVER
3.	NORTHWEST	5,238	TRUCK VIA DEMSTER HIGHWAY BARGE FROM HAY RIVER
4.	NORTH CENTRAL	4,029	BARGE FROM HAY RIVER/INUVIK

Figure 2.3.1

STUDY REGIONS

TABLE 2.3.1

WASTE OIL IN THE NWT, SUMMARY BY REGION

SOUTHWEST REGION

Community	Population	Waste Oil l/a	Contaminated Fuel l/a
Yellowknife	13,011	523,366	12,300
Hay River	2,827	93,127	53,000
Fort Smith	2,505	65,765	0
Rae Edzo	1,443	38,463	0
Fort Simpson	1,006	35,998	0
Fort Providence	577	16,018	0
16 Smaller Communities* (less than 500 pop.)	2,137	155,739	0
TOTAL FOR REGION	**23,506**	**928,477**	**65,300**

Average per capita waste oil generation rate calculates to = 39.5 l/a

* Detah
Enterprise
Fort Liard
Fort Resolutior.
Hay River Reserve
Jean Marie River
Kakisa
Lac La Matre
Nahanni Butte
Paradise Gardens
Pine Point
Reliance
Salt Plains
Trout Lake
Lupin Gold Mine
Neptune Resurces Colomac Mine

TABLE 2.3.2

WASTE OIL IN THE NWT, SUMMARY BY REGION

WEST CENTRAL REGION

Community	Population	Waste Oil l/a	Contaminated Fuel l/a
Fort Good Hope	586	19,699	0
Fort Franklin	550	16,877	0
Norman Wells	536	80,519	0
3 Smaller Communities* (less than 500 pop.)	784	30,126	9,000
TOTALS FOR REGION	**2,456**	**147,220**	**9,000**

Average per capita waste oil generation rate calculates to = 59.9 l/a

* Fort Norman
Snowdrift
Wrigley

TABLE 2.3.3

WASTE OIL IN THE NWT, SUMMARY BY REGION

NORTHWEST REGION

Community	Population	Waste Oil l/a	Contaminated Fuel l/a
Inuvik	2,670	96,088	8,000
Tuktoyaktuk	956	374,103	1,600
Aklavik	777	25,887	0
Fort McPherson	729	21,859	0
Arctic Red River	106	3,613	0
TOTAL FOR REGION	**5,238**	**521,550**	**9,600**

Average per capita waste oil generation rate calculates to = 99.6 l/a

TABLE 2.3.4

WASTE OIL IN THE NWT, SUMMARY BY REGION

NORTH CENTRAL REGION

Community	Population	Waste Oil l/a	Contaminated Fuel l/a
Cambridge Bay	1,027	15,640	0
Coppermine	956	9,692	0
Gjoa Haven	706	6,565	0
Spence Bay	540	11,650	0
5 Smaller Communities* (less than 500 pop.)	800	8,626	0
TOTALS FOR REGION	**4,029**	**52,174**	**0**

Average per capita waste oil generation rate calculates to = 12.9 l/a

* Holman
Paulatuk
Sachs Harbour
Bay Chimo
Bathurst Inlet

Waste oil quantities generated in more populus areas are predictably higher than in less populated areas. The influence of vehicles and industry is clearly recognizable. Of special interest are the per capita waste oil generation rates. Due to the high quantities of waste oil generated by oil exploration (compared to a low population base), the highest per capita generation of waste oil is in the Northwest region due to activity in Tuktoyaktuk, followed by the West Central region, where Norman Wells activity strongly impacts unit rates. If oil and gas exploration were to increase, waste oil quantities would be affected substantially.

The Southwest region has a more diverse selection of waste oil generators and is considerably less sensitive to changes in industrial activity.

2.4 WASTE OIL QUANTITIES BY DISPOSAL METHOD

Of interest for the formulation of waste oil recovery concepts are current waste oil disposal practices. In order to provide a better understanding of the current situation, disposal practices are presented by producing category. Unfortunately, only a relatively small portion of the respondents to the questionnaire identified how they currently dispose of their waste oils. Answers obtained are summarized in Table 2.4.1. Quantities of waste oil reflect figures provided by parties interviewed, with the exception of oil used for fire practice for which actual quantities were not obtained. Quantities used for fire practices are estimates based on verbal communications with waste oil generators and local authorities.

Table 2.4.1 reflects only waste oil. Contaminated fuels from marine transport are all shipped south for refining. Contaminated fuels (slops) from bulk storage plants are reportedly sold locally as low grade fuels.

TABLE 2.4.1
WASTE OIL IN THE NWT
SUMMARY BY DISPOSAL METHOD
Quantities in l/a

Categories	Shipped South	Fuel	Flared	Stored	Dust Control	Land-Filled	Fire Practice	Not Specified	Totals
Marine Transport	15,000		12,300						27,300
Air Transport				1,500	2,250			11,550	15,300
Industries	55,000	65,600	342,834		120,000		10,000	70,000	663,434
Services		47,100	900	10,590		2,300	20,000	49,830	130,720
Vehicles	39,000	33,000		4,000		14,600	60,000	626,838	777,438
Misc.								35,229	35,229
TOTALS	**109,000**	**145,700**	**356,034**	**16,090**	**122,250**	**16,900**	**90,000**	**793,447**	**1,849,421**
%	7	9	22	1	7	1	5	48	100

Waste oils from marine transport operations in Hay River are reportedly shipped south for re-refining. Those originating in Tuktoyaktuk are flared locally (it is considered too costly to ship them for re-refining). In total, about 7% of all waste oil is shipped south for re-refining or other treatment.

About 9% of all waste oil is being used as fuel. The Norman Wells refinery is able to feed all of the waste oil it produces back into the process. Waste oil from power generation is in some cases, such as in Inuvik, blended with fuel oil and used for district heating. Some vehicle service garages burn used crankcase oil for heating purposes and about 33,000 l/a are disposed of in this manner.

Flaring or incineration of waste oil is practiced mainly by oil and gas exploration companies in the high arctic. These companies consider it the most economically and environmentally desirable disposal method. About 22% of all waste oil is flared.

Only 1% of waste oil is reported to be in storage at this time. This appears very low and it can be assumed that a portion of the unspecified quantity of waste oil is also in storage.

Dust control with waste oil is still common practice in the NWT. However, only 7% is reportedly being used for this purpose. Based on experience and conversations with respondents, it is estimated that actual quantities used for dust control will be closer to 15% to 20%.

Similarly, only 1% of all waste oil is being knowingly landfilled. It can be safely assumed that the actual figure is much higher, since many respondents indicated that they know of no other place to dispose of waste oil.

The 5% of waste oil used for fire practice is an estimate only, based on conversations with representatives from the various categories.

All of the above percentages must be viewed with caution, since usable data were only received to cover 52% of the waste oil being disposed.

2.5 COMPARISON OF QUANTITIES WITH 1987 STUDY RESULTS

In the following tables, comparisons are provided between quantities presented in the 1987 report and those obtained for this report.

TABLE 2.5.1
DEVELOPMENT OF WASTE OIL QUANTITIES
BY PRODUCING CATEGORY

Category	Quantities 1987 l	Quantities 1989 l	% Change
Marine Transport	249,000	27,300	-89%
Air Transport	37,800	15,300	-60%
Industries			
- mining	132,600	255,000	+92%
- oil and gas	57,200	408,434	+614%
Public Services	194,800	130,720	-33%
Vehicles (2)	977,100	777,438	-20%
Miscellaneous	(1)	35,230	(1)
TOTALS	**1,648,500**	**1,649,421**	-

Notes:

(1) The miscellaneous category is new in this report. The waste oil covered by this quantity was included in the construction and vehicle categories in the 1987 report.

(2) The vehicles category combines the construction, long distance vehicles, and local vehicles categories from the 1987 report. The three subcategories have been reorganized for the 1989 report and include construction, commercial, and personal/small vehicles.

While the total quantities of waste oil generated are almost unchanged since 1987, the sources of waste oil have shifted significantly.

Lube oil from marine transport is lower for several reasons. One barge company now performs lube oil analysis and has been able to reduce the required number of oil changes from several to about one per year. Another firm uses oil purifiers to reduce lube oil change requirements. In addition, barge activity is reportedly lower than three years ago. In the aviation industry, the conversion by larger aircraft companies to fan and turbo jets (from piston engines) has resulted in some waste oil reduction. A reduction of waste oil from vehicles is due primarily to the increased changing of oil for long distance vehicles outside the NWT. Also, this report lists a separate category of miscellaneous waste oil, which was included under vehicles in the 1988 report. The lower waste oil volume from the public service category appears due to a better response to questionnaires, resulting in more accurate data being available for this report.

Off-setting the downward trend is an increase in waste oil being generated by the industrial sector. An increase in oil and gas exploration has resulted in a significant escalation of waste oil quantities generated. Also, several new mining operations have raised waste oil quantities from this sector.

The changes in waste oil quantities by region are presented in Table 2.5.2.

TABLE 2.5.2

DEVELOPMENT OF WASTE OIL QUANTITIES BY REGION

Region	Quantities 1987 l	Quantities 1989 l	% Change
Southwest	1,087,685	928,477	-15%
West Central	83,355	147,220	+77%
Northwest	445,503	521,550	+17%
North Central	31,952	52,174	+63%
TOTALS	**1,648,495**	**1,649,421**	-

The decline in waste oil quantities for the Southwest region can be directly attributed to the lower quantities being generated by marine transport and long distance vehicles.

Waste oil generated in the Northwest region is increased through oil and gas exploration activities. The increases are tempered by a decline in waste oil from long distance vehicles.

A 77% increase in the West Central region is due to new oil and gas exploration, as well as a revised calculation procedure for crankcase oil from vehicles. In the 1987 report, all communities in the region were assessed as being without road access; however, it has been recognized that winter roads provide considerable traffic and subsequently, more waste oil than previously estimated.

The waste oil increase in the North Central region can be partially explained by a 12% population increase. The balance may be due to a more detailed response (than in 1987) to the questionnaire, resulting in more accurate figures for the region.

It must be kept in mind that in absolute terms, waste oil increases in the two smallest regions amount to only about 84,087 l/a, or 5.1% of the current waste oil production in the western NWT, and are thus not as significant as the percentage figures may indicate.

Contaminated fuel plays a considerably smaller role now than it did in 1987. Generation rates for contaminated fuel are presented in Tables 2.5.3 and 2.5.4.

TABLE 2.5.3

DEVELOPMENT OF CONTAMINATED FUEL QUANTITIES BY PRODUCING CATEGORY

Category	Quantities 1987 l	Quantities 1989 l	% Change
Marine Transport	119,500	45,000	-62%
Air Transport	5,580	-	-100%
Industries; includes bulk fuel plants	27,500	38,900	+41%
Public Services	-	-	
Vehicles	3,600	-	-100%
Miscellaneous	-	-	
TOTALS	**156,180**	**83,900**	**-46%**

Total quantities of contaminated fuels have been reduced by half, primarily due to improved procedures in the marine, air and long distance transportation categories. The amount of contaminated fuels produced by bulk fuel facilities remains virtually unchanged.

TABLE 2.5.4

DEVELOPMENT OF CONTAMINATED FUEL QUANTITIES BY REGION

Region	Quantities 1987 l	Quantities 1989 l	% Change
Southwest	150,380	65,300	-57%
West Central	-	9,000	+100%
Northwest	5,800	9,600	+66%
North Central	-	-	
TOTALS	**156,180**	**83,900**	**-46%**

Predictably, reductions in contaminated fuel are concentrated in the Southwest region, where the majority of contaminated fuels are generated by marine transport and bulk fuel storage. Contaminated fuel in the West Central region is from oil and gas exploration activities.

3.0 SUMMARY AND CONCLUSION

This updated waste oil inventory, when compared to 1987 study results, indicates a number of key trends which are outlined below:

- The largest generators of waste oil are vehicles. It is estimated that about 47% of all waste oil is generated by construction, commercial, and personal/small vehicles. Industries generate about 40% and utilities 7% of the waste oil in the NWT.

- Contaminated fuels play a relatively minor role and make up only 5% of total waste oil. Solvents reportedly make up less than 1%.

- The largest producer of waste oil is the Southwest Region with 56% of the total, followed by the Northwest Region with 32% and the West Central Region with 9%. The North Central Region, lacking road access, generated only 3% of the total waste oil.

- The overall generation of waste oil in the western NWT is about the same as it was in early 1987.

- Greatest reductions were achieved by marine transport companies, who reportedly produce only about 10% of the waste oil they did in 1987. An increasing trend towards servicing long distance trucks and buses in southern provinces reduces waste oil generated by vehicles in the NWT.

- A significant further reduction of waste oil generated is not expected.

- Industry provided the greatest escalation in waste oil quantities through new mining opertions and increased oil and gas exploration activities.

- Largest waste oil increases are evident in those regions with new mining or exploration activity.

- The quantity of contaminated fuels has dropped considerably, since this material is no longer considered waste and is either shipped south for treatment and recovery, or sold locally as low grade fuel. Until very recently, shipments of bulk fuel to the Beaufort were also reduced due to limited exploration activity.

- There is a growing awareness by generators of waste oil of the necessity for proper disposal. Large industries keep records of waste oil quantities and disposal procedures. There appears to be a trend by smaller producers to utilize the heating value of waste oil. Dust suppression is still a common practice, as is landfilling of waste oil.

- There is a need for greater education and communication among smaller waste oil producers. Some have a disposal problem, while others have difficulties keeping a sufficient supply for heating purposes.

- Based on survey results, 15% of waste oil is shipped south for recycling or used as fuel. 27% is flared, or used for fire practice. The remaining oil is either stored, used for dust control or landfilled (10%); or was not specified (48%). It has been estimated that as much as 50% of waste oil might ultimately be available for recycling or reuse.

- The generation of waste oil is sensitive to major industrial activity. The opening of a new mine, an increase in oil and gas exploration, or the construction of a natural gas pipeline from the Beaufort Sea would have the greatest effect on waste oil quantities generated. Waste oil generated by vehicles, construction activities and services can be expected to increase in accordance with population growth.

APPENDIX A

TELEPHONE QUESTIONNAIRE

TELEPHONE QUESTIONNAIRE

WASTE OIL GENERATED

DATE: _____

CONTACT: _____ PHONE NO.: _____

FIRM: _____

LOCATION: _____

TYPE OF WASTE OIL GENERATED: QUANTITY

- lube oil/hydraulic fluids _____
- solvents _____
- contaminated fuels _____

HAS THIS QUANTITY INCREASED/DECREASED IN THE LAST 2 YEARS?_____

BY HOW MUCH? _____

FUTURE CHANGES EXPECTED? _____

CURRENT DISPOSAL METHODS:

- collected and shipped south _____
- used as fuel _____
- flared _____
- stored _____
- dust control _____
- landfilled _____
- fire practice _____
- other _____

ANY PROBLEMS WITH CURRENT DISPOSAL METHODS?

_____

IS THIS OIL, OR PART OF IT AVAILABLE FOR RECOVERY?_____

HOW MUCH? _____

ARE YOU CONSIDERING ANY OIL RECYCLING OR RE-USE METHODS?_____

PLEASE DESCRIBE _____

CAN YOU SUGGEST OTHER GENERATORS WHO WE MIGHT CONTACT?_____

_____

COMMENTS/SUGGESTIONS: _____

_____

_____

_____

APPENDIX B

PERSONAL COMMUNICATIONS

PERSONAL COMMUNICATIONS

AMOCO, CALGARY
ATL, CALGARY
BUFFALO AIRWAYS, HAY RIVER
BYERS TRANSPORT, YELLOWKNIFE
CANADA OIL AND GAS LANDS ADMIN., YELLOWKNIFE
CHEVRON, CALGARY
CITY OF YELLOWKNIFE
CLARK BOWLER, YELLOWKNIFE
COAST GUARD, HAY RIVER
ESSO PETROLEUM, NORMAN WELLS
ESSO PETROLEUM, YELLOWKNIFE
ESSO RESOURCES, CALGARY
FITTING TRACK, INUVIK
FRAME AND PERKINS, YELLOWKNIFE
GIANT YELLOWKNIFE MINES, YELLOWKNIFE
GNWT DEPARTMENT OF STATISTICS
GNWT MOTOR VEHICLES
GNWT PETROLEUM PRODUCTS, CAMBRIDGE BAY
GNWT TRANSPORTATION, HAY RIVER
GNWT, DPW, FORT SIMPSON
GULF-CANADA, CALGARY
INUVIK FIRE DEPARTMENT
KEN BOREK AIR LTD., INUVIK
LUPIN MINE
NAHANNI AIR, NORMAN WELLS
NEPTUNE RESOURCES
NERCO CON MINE, YELLOWKNIFE
NORTH COR, CALGARY
NORTH STAR SERVICE AND CONSTRUCTION, INUVIK
NORTHLAND UTILITIES, HAY RIVER
NORTHWEST TRANSPORT, YELLOWKNIFE
NTCL, HAY RIVER

NWT AIRWAYS, YELLOWKNIFE
NWTPC, FORT SMITH
NWTPC, HAY RIVER
NWTPC, YELLOWKNIFE
PAN ARCTIC, CALGARY
PARAMOUNT RESOURCES, CALGARY
PETE'S TIRE SHOP, YELLOWKNIFE
PETRO CANADA
PETROLEUM PRODUCTS OFFICER, CAMBRIDGE BAY
POINTS NORTH TRANSPORTATION, INUVIK
PREMAY EQUIPMENT, EDMONTON
R. ANGUS, INUVIK
RJK MOBILE, YELLOWKNIFE
ROBINSON'S TRUCKING, YELLOWKNIFE
VOLKER STEVIN, YELLOWKNIFE
YELLOWKNIFE MOTORS, YELLOWKNIFE

APPENDIX C

BACKGROUND CALCULATIONS

CALCULATION OF WASTE OIL FROM VEHICLES

* Waste oil generated by all types of vehicles is calculated based on the number of registrations (as published by GNWT Motor Vehicles) and the specific waste oil generation rate for each major vehicle category (see calculation basis below).

Vehicle	Registrations	L Oil/Year	Waste Oil In Litres
Passenger	11,803	10	118,030
Taxi	262	100	26,200
Construction	1,245	260	323,700
Station Wagon	502	10	5,020
1/2 Ton Pick Up	8,809	10	88,090
Van	437	10	4,370
Truck Tractor	1,429	54	77,166
Dump Truck	398	300	119,400
Tow Truck	28	72	2,016
Fire Truck	87	10	870
Ambulance	21	10	210
Hearse	3	10	30
Motorcycle	628	2	1,256
Motorhome	158	10	1,580
Society Bus	50	12	600
Private Bus	5	12	60
Commercial Bus	15	360	5,400
School Bus	41	60	2,460
ATV	98	10	980
TOTAL	**26,019**		**777,438**

Calculation Basis:

1. Passenger vehicles, station wagons, 1/2 ton pick ups, vans, ambulances, hearses, and motorhomes change 5l of oil twice per year.
2. Taxis change 5l of oil 20 times per year.
3. Construction eqiupment generates 260 l/year per machine (based on 5 oil changes @ 52l).
4. Tractor trucks change 45l of oil per month but only 10% of changes occur in the NWT. The remaining oil changes are performed in the southern provinces.
5. Dump trucks change 25l of oil/month.
6. Motorcycles change 2l of oil once per year.
7. ATV's change 10l of oil per year (conservative).
8. Society and private buses change 6l of oil twice per year.
9. Commercial buses change 30l of oil per month.
10. School buses change 5l of oil/month.

The above waste oil generation rates were derived from personal communications with service shops, trucking companies, construction firms, small businesses and private individuals in the NWT.

In total 777,438 l of crankcase oil is generated annually by all communities.

However, communities without road access can be expected to maintain and use fewer vehicles than areas with road or winter road access.

About 12% of the study area population lives in communities without road access but only 2.2% of vehicles are registered in these areas. It has been assumed that waste oil generated is proportional to the number of vehicles registered.

Communities without road access are: Bathurst Inlet, Bay Chimo, Cambridge Bay, Coppermine, Gjoa Haven, Holman, Spence Bay, Paulatuk, Sachs Harbour, Reliance, Snowdrift.

Based on the above figures, 16,815 l of waste crankcase oil are generated by communities without road access, and 760,623 l by those communities with road access. The resulting specific per capita generation rates are thus 3.9 and 24.6 l/person/year respectively.

Waste Oil Available for Recycling

Interviewed parties provided mixed results. Some use all of their waste oil for heating, others would like to dispose of all of their oil. It has been estimated that an average 50% of waste crankcase oil would be available for recycling.

CALCULATION OF WASTE OIL QUANTITIES FROM AIRCRAFT

Rule of Thumb = 150 l/engine per year.

Community	No. of Engines Stationed & Serviced	l/a
Yellowknife	23	3,450
Hay River	15	2,250
Ft. Smith	11	1,650
Ft. Simpson	7	1,050
Edzo	2	300
Ft. Laird	2	300
Inuvik	19	2,850
Norman Wells	8	1,200
Ft. Providence	1	150
Ft. Norman	2	300
Cambridge Bay	2	300
TOTAL		**13,800**

Note:

Many remote aircraft operators use oil for dust suppression. Waste oil from aircraft in larger communities should be mostly available for recycling.

APPENDIX D

COMPUTER SPREADSHEET

TABLE 2.2.1

WASTE OIL IN THE NWT

BY PRODUCING CATEGORY

CATEGORY	LUBE OIL	CONTAMINATED FUELS
MARINE TRANSPORT	27300	45000
AIR TRANSPORT	15300	0
INDUSTRIES		
-Mines	255000	0
-Oil and gas	408434	38900
PUBLIC SERVICES	130720	0
CONSTRUCTION VEHICLES	323700	0
OTHER VEHICLES		
-Commercial	196566	0
-Personal/Small	257172	0
MISCELLANEOUS	35229	0
TOTALS	1649421	83900

WASTE OIL IN THE NWT, SUMMARY BY REGION
FOR ABOVE PRODUCING CATEGORIES

SOUTHWEST	POP WITH ROAD	POP W/O ROAD	CONSTRUCTION	COMMERCIAL	PERSONAL/SMALL
YELLOWKNIFE	13011	0	133240	80909	105856
HAY RIVER	2827	0	28950	17580	23000
FORT SMITH	2505	0	25653	15577	20380
RAE EDZO	1443	0	14777	8973	11740
FORT SIMPSON	1006	0	10302	6256	8185
FORT PROVIDENCE	577	0	5909	3588	4694
OTHER	2126	11	21789	13231	17311
TOTAL	23495	11	240619	146115	191166

WEST CENTRAL	POP WITH ROAD	POP W/O ROAD	CONSTRUCTION	COMMERCIAL	PERSONAL/SMALL
FORT GOOD HOPE	586	0	6001	3644	4768
FORT FRANKLIN	550	0	5632	3420	4475
NORMAN WELLS	536	0	5489	3333	4361
OTHER	521	263	5763	3500	4579
TOTAL	2193	263	22885	13897	18182

NORTHWEST	POP WITH ROAD	POP W/O ROAD	CONSTRUCTION	COMMERCIAL	PERSONAL/SMALL
INUVIK	2670	0	27342	16603	21723
TUKTOYYAKTUK	956	0	9790	5945	7778
AKLAVIK	777	0	7957	4832	6322
FORT McPHERSON	729	0	7465	4533	5931
ARCTIC RED RIVER	106	0	1085	659	862
TOTAL	5238	0	53640	32573	42616

NORTH CENTRAL	POP WITH ROAD	POP W/O ROAD	CONSTRUCTION	COMMERCIAL	PERSONAL/SMALL
CAMBRIDGE BAY	0	1027	1671	1015	1328
COPPERMINE	0	956	1556	945	1236
GJOA HAVEN	0	706	1149	698	913
SPENCE BAY	0	540	879	534	698
OTHER	0	800	1302	790	1034
TOTAL	0	4029	6556	3981	5208

GRAND TOTALS	30926	4303	323700	196566	257172
CHECK	30926	4303	323700	196566	257172

MARINE TRANSPORT	AIR TRANSPORT	INDUSTRIES	SERVICES	MISCELLANEOUS	TOTAL	PER CAPITA
0	4950	160000	25400	13011	523366	40.2
15000	2250	0	3520	2827	93127	32.9
0	1650	0	0	2505	65765	26.3
0	300	0	1230	1448	38463	26.7
0	1050	0	9200	1006	35998	35.8
0	150	0	1100	577	16018	27.8
0	300	95000	5970	2137	155739	72.9
15000	10650	255000	46420	23506	928477	39.5

MARINE TRANSPORT	AIR TRANSPORT	INDUSTRIES	SERVICES	MISCELLANEOUS	TOTAL	PER CAPITA
0	0	0	4700	586	19699	33.6
0	0	0	2800	550	16877	30.7
0	1200	65600	0	556	80519	150.2
0	300	9000	6200	784	30126	38.4
0	1500	74600	13700	2456	147220	59.9

MARINE TRANSPORT	AIR TRANSPORT	INDUSTRIES	SERVICES	MISCELLANEOUS	TOTAL	PER CAPITA
0	2850	0	24900	2670	96008	36.0
12300	0	333834	3500	956	374103	391.3
0	0	0	6000	777	25887	33.3
0	0	0	3200	729	21859	30.0
0	0	0	900	106	3613	34.1
12300	2850	333834	38500	5238	521550	99.6

MARINE TRANSPORT	AIR TRANSPORT	INDUSTRIES	SERVICES	MISCELLANEOUS	TOTAL	PER CAPITA
0	300	0	10300	1027	15640	15.2
0	0	0	5000	956	9692	10.1
0	0	0	3100	706	6565	9.3
0	0	0	9000	540	11650	21.6
0	0	0	4700	800	8626	10.8
0	300	0	32100	4829	52174	12.9
27300	15300	663434	130720	35229	1649421	53.3
27300	15300	663434	130720	35229	1649421	53.3

POPULATION OF STUDY AREA=	35229
WITH ROAD ACCESS=	30926
WITHOUT ROAD ACCESS=	4303

PER CAPITA WASTE OIL GENERATION RATES

	WITH ACCESS	WITHOUT ACCESS
CONSTRUCTION	10.24	1.63
COMMERCIAL VEHICLES	6.22	0.99
PERSONAL/SMALL VEHICLES	8.14	1.29

WASTE OIL GENERATED BY VEHICLES

VEHICLE	REGISTRATIONS	L OIL/YEAR	WASTE OIL
PASSENGER	11803	10	118030
TAXI	262	100	26200
CONSTRUCTION	1245	260	323700
STATION WAGON	502	10	5020
1/2 TON PICKUP	8809	10	88090
VAN	437	10	4370
TRUCK TRACTOR	1429	54	77166
DUMP TRUCK	398	300	119400
TOW TRUCK	28	72	2016
FIRE TRUCK	87	10	870
AMBULANCE	21	10	210
HEARSE	3	10	30
MOTORCYCLE	628	2	1256
MOTORHOME	158	10	1580
SOCIETY BUS	50	12	600
PRIVATE BUS	5	12	60
COMMERCIAL BUS	15	360	5400
SCHOOL BUS	41	60	2460
ATV	98	10	980
TOTAL	26019		777438
TOTAL WITH ROAD ACCESS	25456		760623
TOTAL WITHOUT ROAD ACCESS	563		16815

COMMUNTITIES WITHOUT ROAD ACCESS

COMMUNITY	POPULATION	REGISTRATIONS	REG/POP
BATHURST INLET	16		
BAY CHIMO	64		
CAMBRIDGE BAY	1027	257	0.250
COPPERMINE	956	87	0.091
GJOA HAVEN	706	25	0.035
HOLMAN	316	30	0.095
SPENCE BAY	540	50	0.093
PAULATUK	233		
SACHS HARBOUR	171	37	0.216
RELIANCE	11		
SNOWDRIFT	263		
TOTAL	4303	486	0.131
# OF REGISTRATIONS ADJUSTED		563	
% OF STUDY AREA	12.2	2.2	